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SYSTEM-LEVEL DESIGN ANALYSIS (SLDA) DICTIONARY

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ABSTRACT: This document defines the parameters (attributes) that affect the system-level interaction of Digital hardware products. Included in this document are a product hierarchy for classification of system-level hardware products, definitions of system interaction attributes, an assignment of these attributes to product classes, and an attribute classification. The information in this document has been extracted from the SLDA data base, Version 3.4.

APPLICABILITY: This document is applicable to all software and hardware engineers involved with the development and evaluation of computer products at system level.

STATUS: APPROVED 30-Nov-1989; use VTX SMC for current status.

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System-Level Design Analysis (SLDA) Dictionary

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CHAPTER 1

INTRODUCTION

System-Level Design Analysis (SLDA) is an advanced development project of the System Evaluation Engineering (SEE) group. SEE is a part of the System Integration Engineering (SIE) group under Computer System Manufacturing Engineering and Technology. The goal of the SLDA project is to develop a methodical and focused approach to the system-level testing and design of Digital hardware products, and to define a consistent terminology for product parameters and attributes.

The SLDA Dictionary describes the parameters that affect system-level interaction of Digital products. These parameters are typically specified on the product's specification, created during Phase 1 of product development, and typically apply to a product's hardware configuration or hardware connections. In this document, these parameters are defined with respect to their contribution to system interaction analysis.

Chapter 2 of this document describes the classification of system-level Digital products in the SLDA Product Hierarchy. Chapters 3, 4, and 5 address system interaction attributes and provide for each attribute a definition, classification, and assignment to various product groups in the Product Hierarchy. Chapter 6 contains an attribute thesaurus. The thesaurus lists the synonymous terms used by different engineering groups in Digital to represent the attributes contained in the SLDA data base. Also included, in Chapter 7 of this document, is a classification of hardware risks applicable to the system interaction realm, and a description of the terms used in risk classification.

The majority of this document was prepared from the SLDA knowledge base through an automated process; therefore, the SLDA Dictionary represents the same knowledge contained in the latest interactive prototype, but in hard copy form. Please note that this release of the Dictionary (and the SLDA prototype) may be missing some of the attributes for recently announced products. These will be added to SLDA knowledge base in the next release.

The SLDA development group would like your comments on the technical contents of the Dictionary; please fill out and return the Feedback Form attached at the end of the document.†

† Full reports describing progress on the project to date may be obtained from Richard Anderson, at DTN: 227-3762, SLDA::ANDERSON.

CHAPTER 2

PRODUCT HIERARCHY

This chapter defines the classes used in the SLDA Hardware Product Hierarchy and their interrelationships.

The Product Hierarchy provides for the organization of all system-level hardware products into the "tree" structure shown in Figure 1. This classification structure offers several levels of abstraction for potential analysis by a user. It allows for subsequent refinement in the analysis by stepping down a level in the hierarchy to add more details to the product characteristics. For example, a Disk product will inherit all of the characteristics of the more general class, Mass Storage. These will then be inherited, along with specific Disk characteristics, to the Hard Disk class.

The Product Hierarchy also provides a standard vocabulary for system-level products, as defined in this chapter. It should be noted that the vocabulary introduced here may require additional resolution when used in reference to specific product issues, but is relevant for general system-level analysis.

BARCODE-READER
A subclass of SERIAL whose members use an optical device to read numerical data represented by bars of various widths spread out along the horizontal axis.

BRIDGE
An ETHERNET product that actively monitors and passes network traffic between two different segments of the Ethernet network. This is based upon acquired knowledge of the location of nodes by address, which is then compared to the destination address of an arriving packet.

BUS-ADAPTER
A subclass of INTRA-SYSTEM interconnects whose members link one general purpose bus to another (typically one parallel bus to another parallel bus).

CARD-READER
A subclass of PARALLEL whose members use an optical device to read data that is represented by perforations on punched cards.

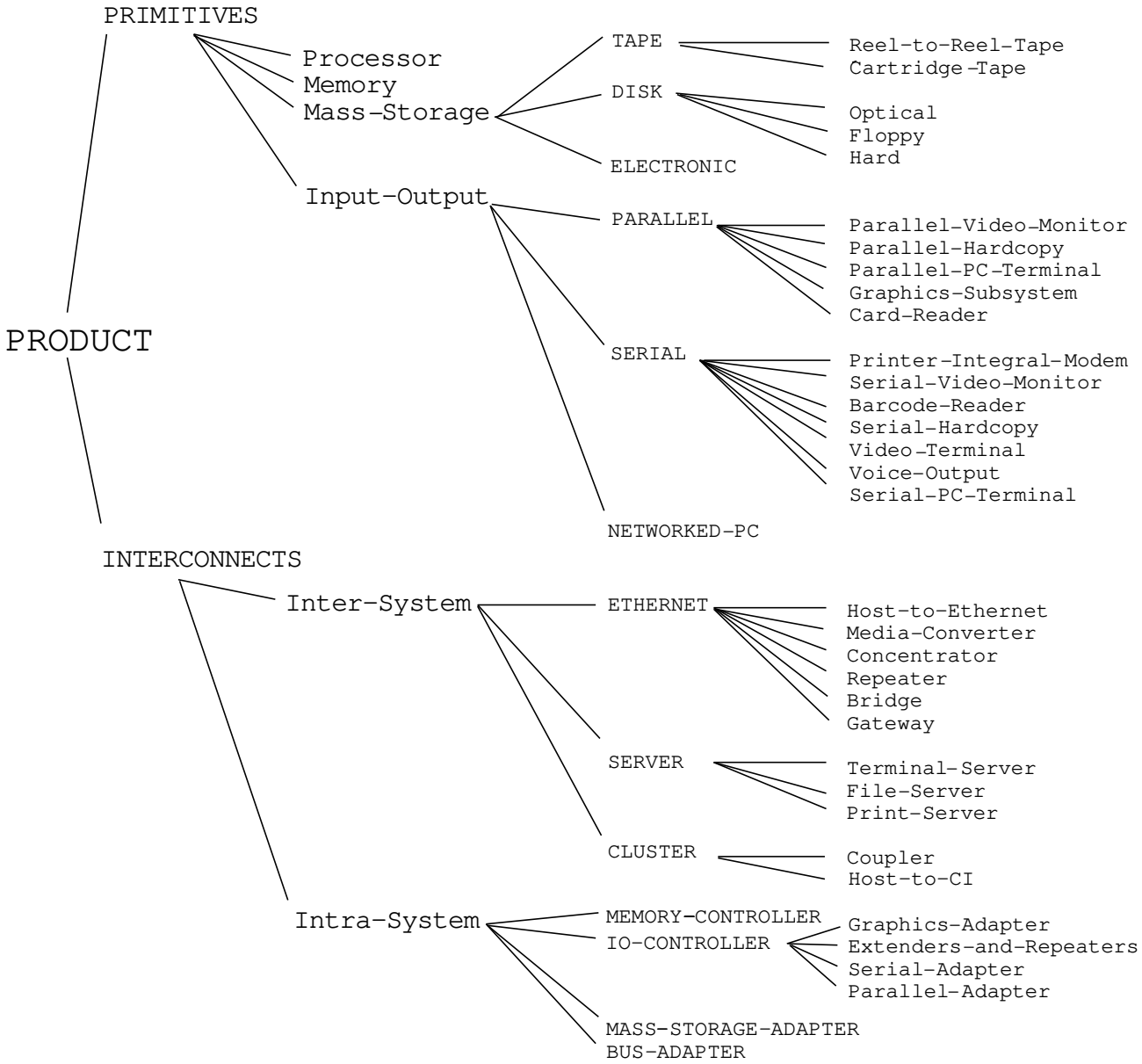
CARTRIDGE-TAPE
A subclass of TAPE whose members store and retrieve data using a magnetic tape contained in a small, removable, modular unit.

CLUSTER
An INTER-SYSTEM subclass of products that either provide a connection path for all the nodes in a cluster (coupler) or provide a link from a processor to the Computer Interconnect (CI).

CONCENTRATOR

A subclass of ETHERNET whose members have the ability to connect multiple nodes via a local network interconnect (bus) to an Ethernet transceiver connected to a backbone or to each other (local).

Figure 1: Product Hierarchy



COUPLER

A subclass of CLUSTER whose members act as a central connection point for nodes in a cluster, with the ability to receive and distribute bus signals transmitted by a node on the cluster to other nodes on that cluster.

DISK

A subclass of MASS-STORAGE whose members are electromechanical devices that rotate magnetic or optical storage media past movable or fixed read/write heads.

ELECTRONIC

A subclass of MASS-STORAGE whose members use an electronic storage array [such as Dynamic Random Addressable Memory (DRAM)] along with an internal controller (which converts a memory address into its corresponding cylinder, track, and sector addresses) to emulate a disk with reduced access time.

ETHERNET

An INTER-SYSTEM subclass of products that provides a DECnet (or other network) link between computer systems, between networks of computer systems, or between various communications media of the network, via a port that meets Ethernet standards.

EXTENDERS-AND-REPEATERS

A subclass of IO-CONTROLLERS whose members amplify or otherwise condition signals received from one piece of a transmission medium and passes these signals to another similar piece of a transmission medium, without altering the contents.

FILE-SERVER

A SERVER product whose members are designed to read and write files to the MASS-STORAGE devices for multiple hosts and to perform control activities (such as error handling or seek optimization) that reduce the load on the host computer and improve the performance of the computer system.

FLOPPY

A DISK product that stores and retrieves data using a flexible, nonrigid, magnetic disk.

GATEWAY

An ETHERNET product that actively monitors and passes network traffic between two different segments of a network. This is based on knowledge of the protocols (such as Ethernet to SNA) used by the two segments and also of the location of nodes by address, which is compared to the destination address of the arriving packet.

GRAPHICS-ADAPTER

An IO-CONTROLLER product that permits the attachment of a graphics terminal (a terminal with the ability to receive and display two-dimensional images) to a host bus.

GRAPHICS-SUBSYSTEM

A PARALLEL product whose members enable graphics processing to be off-loaded from the host processor by controlling the communication functions, the terminal emulation, and the updating of image memory.

HARD

A subclass of DISK whose members use a flat circular plate with a magnetic surface on which data can be stored by magnetic encoding of portions of the flat surface.

HOST-TO-ETHERNET

An ETHERNET product that provides communication between the host processor and the Ethernet data link. A "host" as used here refers to the CPU from which this interconnect product receives control information via one of its non-Ethernet ports.

HOST-TO-CI

A CLUSTER product that connects processor nodes (VAX) and intelligent MASS-STORAGE subsystems (HSC) to the Computer Interconnect (CI), which, through the COUPLER, provides the physical means of connection for the non-Ethernet nodes of a VAXcluster.

IO-CONTROLLER

A subclass of INTRA-SYSTEM whose members link an INPUT-OUTPUT product to the computer system and also direct the operation of the IO devices connected to it.

INPUT-OUTPUT

The major hybrid product group whose members are characterized by the function of transducing data from an electronic form to an audible/visual/tactile form sensible to a human being (or, in the inverse direction, from electronic to human-sensible). INPUT-OUTPUT is a subclass of PRIMITIVES.

INTERCONNECTS

A product that provides the linking and matching functions between PRIMITIVES. These hardware interfaces, in combination with the links that connect products together, are of primary importance since interactions between products occur on these paths.

INTER-SYSTEM

INTERCONNECTS that link and/or match PRIMITIVES from one computer system to another, from one computer system to many other systems, or from one PRIMITIVES product to many computer systems (shared access). INTER-SYSTEM is a subclass of INTERCONNECTS.

INTRA-SYSTEM

An INTERCONNECTS subclass that links and/or matches PRIMITIVES within one computer system. These products are often called adapters, controllers, or repeaters and typically provide the matching and linking function between a MASS-STORAGE or INPUT-OUTPUT product and the PROCESSOR-to-MEMORY bus.

MASS-STORAGE

The major hybrid product group whose members are characterized by the function of storing large quantities of data for long periods of time without the application of electrical power. MASS-STORAGE products transduce data from an electrical signal to a magnetic or optical modulation of the media to provide nonvolatile storage. MASS-STORAGE is a subclass of PRIMITIVES.

MASS-STORAGE-ADAPTER

A subclass of INTRA-SYSTEM whose members link a MASS-STORAGE product to the computer system and may also direct the operation of the mass storage device connected to it. MASS-STORAGE products that have integral controllers typically require an adapter to connect from their port to the computer system.

MEDIA-CONVERTER

A subclass of ETHERNET whose members provide communication capabilities between one type of medium and another. A medium may be a wire, coaxial cable, fiber optics, air, or vacuum used to propagate electrically represented information.

MEMORY

The major hybrid product group whose members are characterized by the function of storing data for later processing. Specifically, MEMORY means main memory; that is, the electronic storage array accessed by the processor and peripheral devices. It does not include on-board cache, rotating magnetic, or optical nonvolatile storage products. MEMORY is a subclass of PRIMITIVES.

MEMORY-CONTROLLER

A subclass of INTRA-SYSTEM whose members interface a memory array board or boards to the computer system and also direct the operation of the memory arrays connected to it. This function is often an integral part of the memory board in recent designs.

NETWORKED-PC

A subclass of INPUT-OUTPUT whose members must be personal computers and have a direct local area network, such as an Ethernet connection. In the analysis of distributed systems, the personal computer must be treated similar to other network nodes unless it is known to perform limited network functions.

OPTICAL

A subclass of DISK, OPTICAL refers to any product that carries data that has either been written or read by a light-based process.

PARALLEL

A subclass of INPUT-OUTPUT whose members must have a parallel port (as contrasted to a serial port) linking them to the computer system, network, or cluster.

PARALLEL-ADAPTER

An IO-CONTROLLER product, the PARALLEL-ADAPTER is a module designed to interface peripheral devices that transmit and receive parallel data to the host computer.

PARALLEL-HARDCOPY

A PARALLEL product whose members receive data through a parallel port and transfer it to paper through a printing process.

PARALLEL-PC-TERMINAL

A subclass of PARALLEL whose members are one of Digital's personal computer products and have at least one parallel port linking the personal computer to a host computer or a peripheral, such as a printer.

PARALLEL-VIDEO-MONITOR

A subclass of PARALLEL whose members use a video device containing a cathode ray tube (CRT) to display screen images.

PRIMITIVES

A product that is a member of one of the four major hybrid product groups that constitute the primitive system elements necessary for the computer processing of data. These groups are:

Processor
Memory
Mass Storage
Input-Output

PRIMITIVES are a subclass of PRODUCT.

PRINTER-INTEGRAL-MODEM

A SERIAL product whose members have modem capability and telephone line connectors built into the printer.

PRINT-SERVER

An integral, high-speed Ethernet interconnect connected to systems to support distributed printing. PRINT-SERVER is a subclass of SERVER.

PROCESSOR

A subclass of PRIMITIVES whose members perform the functions of the central processing unit (CPU) of a computing system (fetching, decoding, and executing instructions; controlling components of the system; and processing data).

PRODUCT

A product is defined as any item that carries a Digital part number and is either sold or supplied to customers as part of a computing environment (such as a system, cluster, or network). SLDA uses a reduced subset of Digital products; this subset is obtained by eliminating products that do not have system interaction impact and by compressing multiple product variants into a representative product name. The resultant subset of products are referred to as "system building blocks" and are the only products represented in the SLDA knowledge base.

REEL-TO-REEL-TAPE

A TAPE product whose members store and retrieve data using a magnetic tape on a removable reel.

REPEATER

An ETHERNET product that amplifies or otherwise conditions a signal for transmission between two different segments of the Ethernet network topology, without changing the signal's content.

SERIAL

A subclass of INPUT-OUTPUT whose members must have a serial port (as opposed to a parallel port) linking them to the computer system, network, or cluster.

SERIAL-ADAPTER

An IO-CONTROLLER product, the SERIAL-ADAPTER is a module designed to interface peripheral devices that transmit and receive serial data to the host computer.

SERIAL-HARDCOPY

A SERIAL product that receives data through a serial port and transfers it to paper through a printing process.

SERIAL-PC-TERMINAL

A subclass of SERIAL whose members are one of Digital's personal computer products and have at least one serial port linking the personal computer to a host computer or peripheral, such as a printer.

SERIAL-VIDEO-MONITOR

A subclass of SERIAL whose members use a video device containing a cathode ray tube (CRT) to display screen images.

SERVER

An INTER-SYSTEM subclass of products that are designed to perform a specific function for many users, often from multiple computer systems. Servers typically connect PRIMITIVE products to a bus that provides shared access, thus allowing the server to communicate with multiple hosts, and allowing each host to access the resources provided by the SERVER.

TAPE

A subclass of MASS-STORAGE whose members are characterized by the movement of magnetic recording tape past sensing and recording heads. Specifically, Digital tape subsystems are defined to consist of three major components—the transport, formatter, and controller—which are defined as follows.

Transport: A tape drive, exclusive of the data conversion and control electronics provided by the formatter.

Formatter: Part of a magnetic tape subsystem that performs data conversion, speed matching, encoding, first level error recovery, and interfaces to one or more tape transports.

Controller: The part of a mass storage subsystem responsible for interfacing between drives and host computers. Controllers usually multiplex the services of one or more drives among the demands of one or more host computers.

TERMINAL-SERVER

An INTER-SYSTEM product that connects terminals to nodes in a local area network; users have the same capability as if they were connected to the node by direct lines. TERMINAL-SERVER is a subclass of SERVER.

VIDEO-TERMINAL

A subclass of SERIAL whose members use a video device to display the output of a computer system and have an integrated keyboard to provide textual input.

VOICE-OUTPUT

A SERIAL product that uses synthesized voice signals as output from a computer system to a user.

CHAPTER 3

SYSTEM INTERACTION ATTRIBUTES

The hardware attributes that affect the interaction of various system building blocks in an integrated system are defined in the following format.

NAME OF THE ATTRIBUTE *(full name, if not provided by Attribute Name)*
Definition of the attribute. Applicable to: *Applicable product classes.*

ADDR-TRANSLAT-BUFFER-SIZE (*Address-Translation-Buffer-Size*)
Number of bytes in the address translation mechanism's buffer. See ADDRESS-TRANSLATION-BUFFER-WORD-WIDTH for more information.
Applicable to: INTERCONNECTS, PROCESSOR.

ADDRESS-FILTERING
The ability to reduce the total traffic on an extended Local Area Network (LAN) by not forwarding those addresses that have local destination addresses.
Applicable to: ETHERNET.

ADR-TRANSLAT-BUFF-WRD-WID (*Address-Translation-Buffer-Word-Width*)
The width of the virtual address path in the product's address translation buffer. Address translation: the action of translating a virtual address to a physical address. The address translation mechanism is presented with a virtual address, intended access (read or write), and a mode against which to check that access. If the access is allowed and the address maps without faulting, the output of this routine is a physical address corresponding to the specified virtual address.
Applicable to: PROCESSOR.

ALLOWABLE-ADDRESS-RANGE
The range of addresses to which the device can respond - typically a subset of the total address range of the bus.
Applicable to: MEMORY.

ALU-WIDTH (*Arithmetic-Logic-Unit-Width*)
The number of bits the ALU (Arithmetic Logic Unit) processes at its input.
Applicable to: PROCESSOR.

ARBITRATION-TIMING
The timing relationship between the arbitration of a request and the data transfer that occurs as a result of that request. (Fixed: Connection must request the data transfer facilities at a fixed time relative to the data transfer. Variable: Connection may request the data transfer facilities at any time.)
Applicable to: INTERCONNECTS.

ARBITRATOR
An indicator of whether or not this device provides control over determining the next device to use the bus.
Applicable to: INTERCONNECTS, PROCESSOR.

AVG-DATA-RATE (*Average-Data-Rate*)
The average rate of typically sized data transfers through the port.
Applicable to: PRODUCT.

BLOCK-MODE-TRANSFERS
An indicator of whether or not the product supports block mode data transfers.
Applicable to: INTERCONNECTS, MEMORY.

BROAD-REC-FREQ (*Broadband-Receive-Frequency*)
The carrier frequency at which the broadband network device receives data.
Applicable to: ETHERNET.

BROAD-TRANS-FREQ (*Broadband-Transmit-Frequency*)
The frequency at which the broadband network device transmits data.
Applicable to: ETHERNET.

CACHE-MEMORY-CAPABILITY
The ability of the CPU to operate with a cache memory. (such as: Not supported, On-board, or Off-board.)
Applicable to: PROCESSOR.

CACHE-MEMORY-SIZE
The number of bytes in the cache memory. (Cache memory: a small, high-speed memory placed between the slower main memory and the processor. A cache increases effective memory transfer rates and processor speed. It contains copies of data recently used by the processor, and fetches several bytes of data from memory in anticipation that the processor will access the next sequential series of bytes.)
Applicable to: PROCESSOR.

CACHE-MEMORY-TYPE
The type of the cache memory (also see CACHE-MEMORY-SIZE). Examples: associative, set associative, direct mapping.
Applicable to: PROCESSOR.

CACHE-MEMORY-WORD-WIDTH
The number of bits in a word of cache memory (also see CACHE-MEMORY-SIZE).
Applicable to: PROCESSOR.

CHARACTER-SET-TYPE
The type of character sets supported by the IO product. Examples: text, VT100 graphics display protocols.
Applicable to: INPUT-OUTPUT.

CONTROL-STORE-FIXED-SIZE
The number of read-only words in the microcode that provide control for the product.
Applicable to: PRODUCT.

CONTROL-STORE-WORD-WIDTH
The number of bits in a microcode word.
Applicable to: PRODUCT.

CONTROL-STORE-WRTBL-SIZE (*Control-Store-Writable-Size*)
The number of read/write words in the microcode that provide control for the product.
Applicable to: PRODUCT.

DATA-BUF-NUM-REC (*Data-Buffer-Number-Receive*)
The number of receive data buffers.
Applicable to: INTERCONNECTS.

DATA-BUF-NUM-TRANS (*Data-Buffer-Number-Transmit*)
The number of transmit data buffers.
Applicable to: INTERCONNECTS.

DATA-BUF-SIZE-REC (*Data-Buffer-Size-Receive*)
The number of bytes used to buffer incoming data.
Applicable to: INTERCONNECTS.

DATA-BUF-SIZE-TRANS (*Data-Buffer-Size-Transmit*)
The number of bytes used to buffer outgoing data.
Applicable to: INTERCONNECTS.

DATA-BUF-TYPE-REC (*Data-Buffer-Type-Receive*)
The type of buffer used for incoming data.
Applicable to: INTERCONNECTS.

DATA-BUF-TYPE-TRANS (*Data-Buffer-Type-Transmit*)
The type of buffer used for outgoing data.
Applicable to: INTERCONNECTS.

DATA-BUFFER-PURGE-METHOD
A method used to determine when to empty the buffer.
Applicable to: INTERCONNECTS.

DATA-CYLINDERS
The maximum number of cylinder tracks at the same radius on all recording surfaces of a disk that may contain data storage.
Applicable to: DISK.

DEDICATED-DIAGNOSTIC-AREAS
Yes/No - Are there sectors/tracks/cylinders dedicated for diagnostics on the disk?
Applicable to: DISK.

DISK-RECORDING-DENSITY
The maximum number of bits per square inch stored on a disk recording surface.
Applicable to: DISK.

DISPLAY-PROTOCOLS
The standardized names of common printable character sets and graphics' protocols supported by the IO product. Examples: ASCII, DEC multinational, Sixel, ReGIS.
Applicable to: INPUT-OUTPUT.

DMA-SUPPORTED (*Direct-Memory-Access-Supported*)
The product can become bus master and transfer data without intervention from the CPU.
Applicable to: INTERCONNECTS.

EMULATION-CAPABILITY
Yes/No - Does the IO product have the capability to emulate any another product?
Applicable to: INPUT-OUTPUT.

ENCODING-STD (*Encoding-Standard*)
This attribute describes what standard is used to encode the bit pattern for transmission in a packet.
Applicable to: INTER-SYSTEM.

ERROR-HANDLING-BITS
The number of bits used to implement a particular error-handling technique.
Applicable to: PRODUCT.

ERROR-HANDLING-TYPE
The characteristics of the error detecting and correcting capabilities of the product. Examples: CRC (Cyclic Redundancy Check), checksums, parity. From a memory controller point of view, the ECC (Error Correction Code) of the memory automatically corrects single-bit memory errors and detects double-bit memory errors. The ECC provides protection from nonrepeating errors by automatically correcting affected data words.
Applicable to: PRODUCT.

ETHERNET-TRANS-TECH (*Ethernet-Transmission-Technology*)
The technology employed to transmit Ethernet information packets, such as broadband (CATV cable), baseband (50 ohm coaxial), microwave (air), or optical (glass fiber).
Applicable to: ETHERNET.

EXTERNAL-ADDRESS-WIDTH
The number of signal lines used to identify the address of the operation at the interface to the product (the port).
Applicable to: PRODUCT.

EXTERNAL-CNTRL-STAT-WIDTH (*External-Control-Status-Width*)
The number of signal lines used for operation control or status information at the interface to the product (the port).
Applicable to: PRODUCT.

EXTERNAL-DATA-WIDTH
The number of signal lines used for data at the interface to the product (the port).
Applicable to: PRODUCT.

FLOW-CONTROL
The method(s) used to distribute the amount of traffic in order to optimize the amount of network activity. (Isarithmic: The number of packets is held constant. Buffer Storage Allocation: Space must be reserved at the destination for message reassembly before the message can be introduced into the network. Special Route Assignment: Attempts to control congestion by altering the routing on the basis of long-term traffic patterns.)
Applicable to: INTER-SYSTEM.

FORMATTED-CAPACITY
The amount of actual user data (in bytes) a disk drive is capable of recording with all overhead accounted for.
Applicable to: MASS-STORAGE.

GENERATE-DETECT-CRC *Generate-Detect-Cyclic-Redundancy-Check*
The product's use of CRC (Cyclic Redundancy Check) error detection/correction (generate, detect, both, or not applicable).
Applicable to: INTER-SYSTEM, MASS-STORAGE-ADAPTER.

GRAPHICS-CAPABILITY
Yes/No - The ability of an IO-product to support graphics.
Applicable to: INPUT-OUTPUT.

INTERLEAVING (*Interleaving-Capability*)
Yes/No - Whether or not any type of address interleave scheme is used within a storage product. Interleaving allows memory to be accessed quicker.
Applicable to: MASS-STORAGE, MEMORY.

INTERNAL-ADDRESS-WIDTH
The number of signal lines used to identify the address of the operation within the product.
Applicable to: PRODUCT.

INTERNAL-CLOCK-FREQUENCY
The transition rate of the internal state machine clock signal, expressed in Hertz. (Note: The actual internal clock(s) can be: master clocks, independent/dependent, source/receiver, asynchronous/synchronous, or delay/continuous-clocking.)
Applicable to: INPUT-OUTPUT, INTERCONNECTS, MEMORY, PROCESSOR.

INTERNAL-CNTRL-STAT-WIDTH (*Internal-Control-Status-Width*)
The number of signal lines used for operation control or status information within the product.
Applicable to: PRODUCT.

INTERNAL-DATA-WIDTH
The number of signal lines used for data within the product.
Applicable to: PRODUCT.

INTERRUPT-ARBITRATION-TYP (*Interrupt-Arbitration-Type*)
A method of determining the order in which hardware interrupts are serviced (for example: centralized-proximity, round-robin).
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INTRA-SYSTEM, PROCESSOR.

INTERRUPT-PRIORITY-LEVEL
The number of hardware interrupt levels supported by the product. The default level at which the product hardware can post interrupts (some products have changeable levels).
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INTRA-SYSTEM, PROCESSOR.

MAP-REG-ADDRESS-WIDTH (*Map-Register-Address-Width*)
The number of bits in the map register devoted to address translation. Other bits may encode control information.
Applicable to: INTRA-SYSTEM, PROCESSOR.

MAX-ARRAY-SIZE (*Maximum-Array-Size*)
The maximum size of the memory array supported by the controller.
Applicable to: MEMORY-CONTROLLER.

MAX-COMMAND-BUFFER-SIZE (*Maximum-Command-Buffer-Size*)
The number of bytes that can be stored in the command buffer.
Applicable to: INTERCONNECTS.

MAX-DATA-RATE (*Maximum-Data-Rate*)
The peak rate of typically sized data transfers through the port.
Applicable to: PRODUCT.

MAX-DEVICES-PER-PORT (*Maximum-Devices-Per-Port*)
The maximum number of products that can be connected to a port; used to show how many drives can be connected to the controller or how many memory modules can be plugged into the controller.
Applicable to: MASS-STORAGE-ADAPTER, MEMORY-CONTROLLER.

MAX-ERROR-CORRECT (*Maximum-Error-Correction*)
The maximum number of failing bits that are correctable for a given data size (for example: double-bit or single-bit error).
Applicable to: PRODUCT.

MAX-ERROR-DETECT (*Maximum-Error-Detection*)
The maximum number of failing bits that are detectable for a given data size (for example: double-bit or single-bit error).
Applicable to: PRODUCT.

MAX-PACKET-SIZE (*Maximum-Packet-Size*)
The maximum number of bytes contained in a message or data packet.
Applicable to: INTER-SYSTEM.

MAX-READ-ACCESS-CACHE (*Maximum-Read-Access-Cache*)
The maximum time that may elapse between requesting data and receiving it from the memory cache.
Applicable to: PROCESSOR.

MAX-READ-ACCESS-TIME (*Maximum-Read-Access-Time*)
The maximum time that may elapse between requesting data and receiving it. This depends on the seek, settle, rotational-latency times and the time to transfer the data to the requesting device.
Applicable to: INTERCONNECTS, MASS-STORAGE, MEMORY.

MAX-REQUEST-LATENCY-TIME (*Maximum-Request-Latency-Time*)
The maximum tolerable delay from when a device issues a request to when the request is granted. (If the value is exceeded, the device may corrupt the data.)
Applicable to: INTERCONNECTS.

MAX-ROTAT-LATENCY-TIME (*Maximum-Rotational-Latency-Time*)
The maximum delay while waiting for a rotating memory to reach a given location as desired by the user. Average latency is the time for the disk to complete half of a revolution.
Applicable to: DISK.

MAX-SEEK-TIME (*Maximum-Seek-Time*)
The maximum time to position the head from the current track to the desired track on a rotational mass-storage product.
Applicable to: DISK.

MAX-SETTLE-TIME (*Maximum-Settle-Time*)
The maximum time to align the head(s) with the center of the track (mass-storage).
Applicable to: DISK.

MAX-THROUGHPUT (*Maximum-Throughput*)
The maximum rate at which information may flow through a device in bytes per second.
Applicable to: INTERCONNECTS.

MEM-ADDR-SPACE-SUPPORTED (*Memory-Address-Space-Supported*)
The amount of physical address space of memory the product can support.
Applicable to: PROCESSOR.

MEMORY-CAPACITY
The amount of data a memory is capable of storing on a single array module.
Applicable to: MEMORY.

MIN-INTERFRAME-GAP (*Minimum-Interframe-Gap*)
The minimum amount of time that must separate frames.
Applicable to: INTER-SYSTEM.

MIN-MEMORY-CYCLE-TIME (*Minimum-Memory-Cycle-Time*)
The minimum time elapsed between access requests from memory. For Static RAMs, cycle time typically equals access time; for Dynamic RAMs, cycle time equals access time plus overhead.
Applicable to: MEMORY.

MIN-PACKET-SIZE (*Minimum-Packet-Size*)
The minimum number of bytes contained in a message or data packet.
Applicable to: INTER-SYSTEM.

MIN-READ-ACCESS-CACHE (*Minimum-Read-Access-Cache*)
The minimum time that may elapse between requesting data and receiving it from the cache.
Applicable to: PROCESSOR.

MIN-READ-ACCESS-TIME (*Minimum-Read-Access-Time*)
The minimum time that can elapse between requesting data and receiving it. For example, in disk products this depends on the seek, settle, and rotational-latency times.
Applicable to: INTRA-SYSTEM, MASS-STORAGE, MEMORY.

MIN-SEEK-TIME (*Minimum-Seek-Time*)
The minimum time to position the head from the current track to the adjacent track on a rotational mass-storage product (track-to-track).
Applicable to: DISK.

MIN-SETTLE-TIME (*Minimum-Settle-Time*)
The minimum time to align the heads with the center of the track (mass-storage).
Applicable to: DISK.

MODE-OF-TRANSMISSION
Serial/Parallel - The type of transfers taking place through the port.
Applicable to: INTERCONNECTS.

MODEM-CONFIG-SUPPORTED (*Modem-Configuration-Supported*)
The ability of the IO-product to support a modem.
Applicable to: INPUT-OUTPUT.

NET-TOPOLOGY (*Network-Topology*)
The geometric arrangement of the links and nodes that make up a network.
Applicable to: INTER-SYSTEM.

NUMB-OF-ADDR-TRANSLAT-BUF *Number-of-Address-Translation-Buffers*
The number of buffers used to translate virtual addresses to physical addresses.
Applicable to: PROCESSOR.

NUMB-OF-ADRSBL-REGISTERS (*Number-of-Addressable-Registers*)
The total number of registers observable or programmable by software or other devices.
Applicable to: PROCESSOR.

NUMB-OF-BIDIRECT-LINES (*Number-of-Bidirectional-Lines*)
The number of external address, data, or control/status lines that are used to both send and receive data.
Applicable to: PRODUCT.

NUMB-OF-MAP-REGISTERS (*Number-of-Map-Registers*)
The number of registers dedicated within the product to mapping from one bus address space to another.
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INTRA-SYSTEM.

NUMB-OF-PRIORITY-LEVELS (*Number-of-Priority-Levels*)
Number of priority levels implemented by the product with the given interrupt arbitration method.
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INTRA-SYSTEM, PROCESSOR.

NUMB-OF-RETRYS (*Number-of-Addressable-Retrys*)
The number of times a device will attempt to retransmit a message when a collision occurs.
Applicable to: INTERCONNECTS.

NUMB-OF-UNIDIRECT-LINES (*Number-of-Unidirectional-Lines*)
The number of external address, data, and control/status lines that are used to either send or receive data, but not both.
Applicable to: PRODUCT.

ORDER-OF-BITS
First-First/First-Last - In a serial data transmission, an indicator of whether the first or last bit is received first.
Applicable to: INTERCONNECTS.

OVERLAPPED-ARBITRATION
The ability to engage in arbitration when a device is currently active on the bus. (Also see ARBITRATION-TIMING.)
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INTRA-SYSTEM.

PORT-ACCESS-TIMEOUT
The time limit that a pending master will wait to become master via the port.
Applicable to: HOST-TO-CI, HOST-TO-ETHERNET, INPUT-OUTPUT, INTRA-SYSTEM, PROCESSOR.

PORT-CLOCK-FREQUENCY
The rate at which the major timing signal transitions at synchronous ports. (Note: The actual internal clock(s) can be: master clocks, independent/dependent, source/receiver, asynchronous/synchronous, or delay/continuous-clocking).
Applicable to: PRODUCT.

PORT-OPERATING-MODE
Full/Half - Indicates whether communication is full or half duplex.
Applicable to: INPUT-OUTPUT, INTERCONNECTS.

PORT-OPERATIONS-SUPPORTED
The actions specified via the bus at the port; often directly or indirectly controlled by a user's computer program [such as: DATI (data in), DATO (data out), and INTLK READ (interlock read)].
Applicable to: PRODUCT.

PORTS-SUPPORTED
A list of the external ports available for linking the device to other devices.
Applicable to: PRODUCT.

PREAMBLE-GENERATE-CAP (*Preamble-Generate-Capability*)
The device generates the preamble for the transmission packet.
Applicable to: INTER-SYSTEM.

PREAMBLE-LENGTH-MAX *Preamble-Length-Maximum*
The maximum number of bits allowed in the preamble.
Applicable to: INTER-SYSTEM.

PREAMBLE-LENGTH-MIN *Preamble-Length-Minimum*
The minimum number of bits allowed in the preamble.
Applicable to: INTER-SYSTEM.

PRINTER-PORT
Yes/No - Does the IO product (typically a video terminal) have a local printer port connection?
Applicable to: INPUT-OUTPUT.

RAM-OR-CAM-OR-SAM (*Random-Addressable | Content-Addressable | Serially-Addressable-Memory*)
The type of memory addressing scheme: either randomly addressable, content addressable, or serially addressable.
Applicable to: MEMORY.

RAMP-UP-TIME
The period of time to go from rest to the read/write speed.
Applicable to: TAPE.

REWIND-SPEED
The rate at which tape can be rewound.
Applicable to: TAPE.

ROM-OR-RWM (*Read-Only-or-Read-Write-Memory*)
The memory device type: either read-only or read/write.
Applicable to: MEMORY.

ROTATIONAL-DEVIATION
The allowable deviation from nominal rotational-speed.
Applicable to: DISK.

ROTATIONAL-SPEED
The rotational rate of the disk's platters at the nominal speed.
Applicable to: DISK.

ROUTING-METHOD
The method used to determine the routing of packets from the source to the destination (such as Deterministic or Stochastic).
Applicable to: INTER-SYSTEM.

SERIAL-CNTRL-STAT-BITS *Serial-Control-Status-Bits*
The number of control and status bits per frame in a serial data transfer.
Applicable to: INTERCONNECTS, MASS-STORAGE, SERIAL.

SERIAL-DATA-BITS
The number of data bits per frame in a serial data transfer.
Applicable to: INPUT-OUTPUT, MASS-STORAGE, SERIAL.

SLAVE-RESPONSE-TIMEOUT
The time limit that a master will wait for a slave to acknowledge a transaction.
Applicable to: INTERCONNECTS, PROCESSOR.

SPLIT-SP-REC-MAX-DATA (*Split-Speed-Receive-Maximum-Data-Rate*)
The peak receive rate of a typically sized data transfer through the port.
Applicable to: IO-CONTROLLER.

SPLIT-SP-TRANS-MAX-DATA (*Split-Speed-Transmit-Maximum-Data-Rate*)
The peak transmit rate of a typically sized data transfer through the port.
Applicable to: IO-CONTROLLER.

SPLIT-SPEED-CAPABILITY
Yes/No - Does the product have the capability to transmit and receive at different speeds?
Applicable to: IO-CONTROLLER, SERIAL.

STANDARD-ARRAY-SIZE
The size of the memory array that comes standard with the controller.
Applicable to: MEMORY-CONTROLLER.

START-TIME
The period of time to achieve nominal rotational speed from rest (including self-test).
Applicable to: DISK.

STATIC-OR-DYNAMIC
The type of memory technology used: static or dynamic. Dynamic memories [(usually Read/Write Memories (RWMs)] require some type of refresh circuitry.
Applicable to: MEMORY.

STOP-TIME
The period of time to come to rest from rotational speed.
Applicable to: DISK.

STREAMING-CAPABILITY
The ability of a tape drive to support the continuous reading or writing from or to the tape, without stopping the tape.
Applicable to: TAPE.

SURFACE-TYPE
The surface coating of a mass-storage medium.
Applicable to: MASS-STORAGE.

TAPE-R/W-SPEED-START-STOP (*Tape-Read/Write-Speed-Start-Stop*)
The rate(s) at which tape can be read or written while performing start-stop operations.
Applicable to: TAPE.

TAPE-R/W-SPEED-STREAMING (*Tape-Read/Write-Speed-Streaming*)
The rate(s) at which tape can be read or written while performing streaming operations.
Applicable to: TAPE.

TAPE-RECORDING-DENSITY
The number of bits per inch of magnetic tape; typical values are 625 bpi (bits per inch), 800 bpi, and 1600 bpi.
Applicable to: TAPE.

TRACKS-PER-CYLINDER
The number of tracks on each disk cylinder. Track: a collection of blocks at a single radius on one recording surface of a disk.
Applicable to: DISK.

TYPE-ALLOCATION-RULES
The method used to resolve or avoid simultaneous requests for resources. (Priority: Rules that let one group obtain resources before the other. Democratic: No priorities; resolved randomly. Sequential: No apparent ties.)
Applicable to: INTERCONNECTS.

UNFORMATTED-CAPACITY
A hypothetical measure of how much user data could be stored in a continuous stream, without headers or error checking.
Applicable to: MASS-STORAGE.

VOLATILE-OR-NONVOLATILE
The memory is volatile if it will not retain its contents in the event of a power loss. Non-volatile memories are either read-only, electrically programmable read/write memories, or battery backed-up read/write memories.
Applicable to: MEMORY.

CHAPTER 4

GENERIC ATTRIBUTE ASSIGNMENT

This section lists the system interaction attributes ascribed to each product class defined in the SLDA knowledge base.

SLDA defines "Generic Attributes" at each level of the Product Hierarchy (refer to Chapter 2). These attributes are common to a class of products within the Product Hierarchy. Also, they are inherited by all the subclasses that are at the lower branches of the Product Hierarchy. In other words, products at each level of the Product Hierarchy have some attributes specific or local to its own class; in addition, it inherits attributes defined for its "parent" product classes in the Product Hierarchy tree.

In this chapter, only local attributes have been listed under each product class. Some of the product classes do not have any local attributes, in which case the classes have been listed without any attribute listings.

For example, FORMATTED-CAPACITY is defined for MASS-STORAGE devices; hence, it is inherited by TAPE devices, DISK devices, and also by all the subclasses of TAPE and DISK devices: REEL-TO-REEL-TAPE and CARTRIDGE-TAPE; and OPTICAL, FLOPPY, and HARD disks. Similarly, DATA-CYLINDERS is a DISK attribute and is inherited by the products at the lower branches of the DISK subtree: OPTICAL, FLOPPY, and HARD disks. As another example, the PRIMITIVE product class does not have any attributes listed underneath, but all the attributes defined at the PRODUCT level are applicable to this product class.

Also, some attributes are applicable to more than one class of products, either at different levels or in the different branches of the tree; hence, these attributes are listed more than once in the following lists. For example, you will find that SLAVE-RESPONSE-TIMEOUT has been listed twice, since it is an attribute for PROCESSORS (but not for other PRIMITIVE products) and for the INTERCONNECT products.

The attributes are listed in following format:

Product Class or Subclass

- Name of the attribute *(full name, if not provided by Attribute Name)*

PRODUCT

The following attributes apply to all Product Classes.

- Avg-Data-Rate (*Average-Data-Rate*)
- Control-Store-Fixed-Size
- Control-Store-Word-Width
- Control-Store-Wrtbl-Size (*Control-Store-Writable-Size*)
- Error-Handling-Bits
- Error-Handling-Type
- External-Address-Width
- External-Cntrl-Stat-Width (*External-Control-Status-Width*)
- External-Data-Width
- Internal-Address-Width
- Internal-Cntrl-Stat-Width (*Internal-Control-Status-Width*)
- Internal-Data-Width
- Max-Data-Rate (*Maximum-Data-Rate*)
- Max-Error-Correct (*Maximum-Error-Correction*)
- Max-Error-Detect (*Maximum-Error-Detection*)
- Numb-of-Bidirect-Lines (*Number-of-Bidirectional-Lines*)
- Numb-of-Unidirect-Lines (*Number-of-Unidirectional-Lines*)
- Port-Clock-Frequency
- Port-Operations-Supported
- Ports-Supported

I. PRIMITIVES

A. PROCESSOR

- Addr-Translat-Buffer-Size (*Address-Translation-Buffer-Size*)
- Adr-Translat-Buff-Wrd-Wid (*Address-Translation-Buffer-Word-Width*)
- ALU-Width (*Arithmetic-Logic-Unit-Width*)
- Arbitrator
- Cache-Memory-Capability
- Cache-Memory-Size
- Cache-Memory-Type
- Cache-Memory-Word-Width
- Internal-Clock-Frequency
- Interrupt-Arbitration-Typ (*Interrupt-Arbitration-Type*)
- Interrupt-Priority-Level
- Map-Reg-Address-Width (*Map-Register-Address-Width*)
- Max-Read-Access-Cache (*Maximum-Read-Access-Cache*)
- Mem-Addr-Space-Supported (*Memory-Address-Space-Supported*)
- Min-Read-Access-Cache (*Minimum-Read-Access-Cache*)
- Numb-of-Addr-Translat-Buf (*Number-of-Address-Translation-Buffers*)
- Numb-of-Adrsbl-Registers (*Number-of-Addressable-Registers*)
- Numb-of-Priority-Levels (*Number-of-Priority-Levels*)
- Port-Access-Timeout
- Slave-Response-Timeout

B. MEMORY

- Allowable-Address-Range
- Block-Mode-Transfers
- Interleaving (*Interleaving-Capability*)
- Internal-Clock-Frequency
- Max-Read-Access-Time (*Maximum-Read-Access-Time*)
- Memory-Capacity
- Min-Memory-Cycle-Time (*Minimum-Memory-Cycle-Time*)
- Min-Read-Access-Time (*Minimum-Read-Access-Time*)
- RAM-or-CAM-or-SAM *Random-Access-or-Content-Addressable-or-Serially-Addressable-Memory*
- ROM-or-RWM (*Read-Only-or-Read-Write-Memory*)
- Static-or-Dynamic
- Volatile-or-Nonvolatile

C. MASS-STORAGE

- Formatted-Capacity
- Interleaving (*Interleaving-Capability*)
- Max-Read-Access-Time (*Maximum-Read-Access-Time*)
- Min-Read-Access-Time (*Minimum-Read-Access-Time*)
- Serial-Cntrl-Stat-Bits (*Serial-Control-Status-Bits*)
- Serial-Data-Bits
- Surface-Type
- Unformatted-Capacity

1. Tape

REEL-TO-REEL-TAPE
CARTRIDGE-TAPE

- Ramp-Up-Time
- Rewind-Speed
- Streaming-Capability
- Tape-R/W-Speed-Start-Stop (*Tape-Read/Write-Speed-Start-Stop*)
- Tape-R/W-Speed-Streaming (*Tape-Read/Write-Speed-Streaming*)
- Tape-Recording-Density

2. Disk

FLOPPY
HARD
OPTICAL

- Data-Cylinders
- Dedicated-Diagnostic-Areas
- Disk-Recording-Density
- Max-Rotat-Latency-Time (*Maximum-Rotational-Latency-Time*)
- Max-Seek-Time (*Maximum-Seek-Time*)
- Max-Settle-Time (*Maximum-Settle-Time*)
- Min-Seek-Time (*Minimum-Seek-Time*)
- Min-Settle-Time (*Minimum-Settle-Time*)
- Rotational-Deviation
- Rotational-Speed
- Start-Time
- Stop-Time
- Tracks-Per-Cylinder

3. Electronic

D. INPUT-OUTPUT

- Character-Set-Type
- Display-Protocols
- Emulation-Capability
- Graphics-Capability
- Internal-Clock-Frequency
- Modem-Config-Supported (*Modem-Configuration-Supported*)
- Port-Access-Timeout
- Port-Operating-Mode
- Printer-Port
- Serial-Data-Bits

1. Parallel

PARALLEL-VIDEO-MONITOR
PARALLEL-HARDCOPY
PARALLEL-PC-TERMINAL
GRAPHICS-SUBSYSTEM
CARD-READER

2. Serial

PRINTER-INTEGRAL-MODEM
SERIAL-VIDEO-MONITOR
BARCODE-READER
SERIAL-HARDCOPY
VIDEO-TERMINAL
VOICE-OUTPUT
SERIAL-PC-TERMINAL

- Serial-Cntrl-Stat-Bits (*Serial-Control-Status-Bits*)
- Serial-Data-Bits
- Split-Speed-Capability

3. Networked-PC

II. INTERCONNECTS

- Addr-Translat-Buffer-Size (*Address-Translation-Buffer-Size*)
- Arbitration-Timing
- Arbitrator
- Block-Mode-Transfers
- Data-Buf-Num-Rec (*Data-Buffer-Number-Receive*)
- Data-Buf-Num-Trans (*Data-Buffer-Number-Transmit*)
- Data-Buf-Size-Rec (*Data-Buffer-Size-Receive*)
- Data-Buf-Size-Trans (*Data-Buffer-Size-Transmit*)
- Data-Buf-Type-Rec (*Data-Buffer-Type-Receive*)
- Data-Buf-Type-Trans (*Data-Buffer-Type-Transmit*)
- Data-Buffer-Purge-Method
- DMA-Supported (*Direct-Memory-Access-Supported*)
- Internal-Clock-Frequency
- Max-Command-Buffer-Size (*Maximum-Command-Buffer-Size*)
- Max-Read-Access-Time (*Maximum-Read-Access-Time*)
- Max-Request-Latency-Time (*Maximum-Request-Latency-Time*)
- Max-Throughput (*Maximum-Throughput*)
- Mode-of-Transmission
- Numb-of-Retrys
- Order-of-Bits
- Port-Operating-Mode
- Serial-Cntrl-Stat-Bits (*Serial-Control-Status-Bits*)
- Slave-Response-Timeout
- Type-Allocation-Rules

A. INTER-SYSTEM

- Encoding-Std (*Encoding-Standard*)
- Flow-Control
- Generate-Detect-CRC (*Generate-Detect-Cyclic-Redundancy-Check*)
- Max-Packet-Size (*Maximum-Packet-Size*)
- Min-Interframe-Gap (*Minimum-Interframe-Gap*)
- Min-Packet-Size (*Minimum-Packet-Size*)
- Net-Topology (*Network-Topology*)
- Preamble-Generate-Cap (*Preamble-Generate-Capability*)
- Preamble-Length-Max (*Preamble-Length-Maximum*)
- Preamble-Length-Min (*Preamble-Length-Minimum*)
- Routing-Method

1. Ethernet

- Address-Filtering
- Broad-Rec-Freq (*Broadband-Receive-Frequency*)
- Broad-Trans-Freq (*Broadband-Transmit-Frequency*)
- Ethernet-Trans-Tech (*Ethernet-Transmission-Technology*)

HOST-TO-ETHERNET

- Interrupt-Arbitration-Typ (*Interrupt-Arbitration-Type*)
- Interrupt-Priority-Level
- Numb-of-Map-Registers (*Number-of-Map-Registers*)
- Numb-of-Priority-Levels (*Number-of-Priority-Levels*)
- Overlapped-Arbitration
- Port-Access-Timeout

MEDIA-CONVERTER
CONCENTRATOR
REPEATER
BRIDGE
GATEWAY

2. Server

TERMINAL-SERVER
FILE-SERVER
PRINT-SERVER

3. Cluster

COUPLER
HOST-TO-CI

- Interrupt-Arbitration-Typ (*Interrupt-Arbitration-Type*)
- Interrupt-Priority-Level
- Numb-of-Map-Registers
- Numb-of-Priority-Levels
- Overlapped-Arbitration
- Port-Access-Timeout

B. INTRA-SYSTEM

- Interrupt-Arbitration-Typ (*Interrupt-Arbitration-Type*)
- Interrupt-Priority-Level
- Map-Reg-Address-Width (*Map-Register-Address-Width*)
- Min-Read-Access-Time (*Minimum-Read-Access-Time*)
- Numb-of-Map-Registers (*Number-of-Map-Registers*)
- Numb-of-Priority-Levels (*Number-of-Priority-Levels*)
- Overlapped-Arbitration
- Port-Access-Timeout

1. Memory-Controller

- Max-Devices-Per-Port (*Maximum-Devices-Per-Port*)
- Max-Array-Size (*Maximum-Array-Size*)
- Standard-Array-Size

2. IO-Controller

GRAPHICS-ADAPTER
EXTENDERS-AND-REPEATERS
SERIAL-ADAPTER
PARALLEL-ADAPTER

- Split-Sp-Rec-Max-Data (*Split-Speed-Receive-Maximum-Data-Rate*)
- Split-Sp-Trans-Max-Data (*Split-Speed-Transmit-Maximum-Data-Rate*)
- Split-Speed-Capability

3. Mass-Storage-Adapter

- Generate-Detect-CRC (*Generate-Detect-Cyclic-Redundancy-Check*)
- Max-Devices-Per-Port (*Maximum-Devices-Per-Port*)

4. Bus-Adapter

CHAPTER 5

ATTRIBUTE CLASSIFICATION

System Interaction attributes have been classified into two broad categories: Structural and Behavioral, and two subcategories: Structural that imply Behavior and Behavioral that imply Structure.

This chapter lists the attributes by their categories. For the description of the attributes, please refer to Chapter 3.

The attributes are listed in following format.

Serial number. Name of the attribute *(full name, if not provided by Attribute Name)*

5.1 STRUCTURAL ATTRIBUTES

Structural Attributes are system attributes pertaining to the way in which the elements of a computer system are arranged or assembled to form a whole system, network, or cluster. Structural Attributes specify the size, type, or presence of an element or describe it in some manner. (Element refers here to the components that make up Digital products, which are defined to be Processors, Memories, Mass Storage, Input/Output, and Interconnect. Examples of elements would be ALU, cache memory, and internal clock. Examples of element descriptors would be memory addressing method and error handling type.)

1. Addr-Translat-Buffer-Size *(Address-Translation-Buffer-Size)*
2. Address-Filtering
3. Adr-Translat-Buff-Wrd-Wid *(Address-Translation-Buffer-Word-Width)*
4. Allowable-Address-Range
5. ALU-Width *(Arithmetic-Logic-Unit-Width)*
6. Arbitrator
7. Block-Mode-Transfers
8. Cache-Memory-Capability
9. Cache-Memory-Size
10. Cache-Memory-Type
11. Cache-Memory-Word-Width
12. Character-Set-Type

13. Control-Store-Fixed-Size
14. Control-Store-Word-Width
15. Control-Store-Wrtbl-Size *(Control-Store-Writable-Size)*
16. Data-Buf-Num-Rec *(Data-Buffer-Number-Receive)*
17. Data-Buf-Num-Trans *(Data-Buffer-Number-Transmit)*
18. Data-Buf-Size-Rec *(Data-Buffer-Size-Receive)*
19. Data-Buf-Size-Trans *(Data-Buffer-Size-Transmit)*
20. Data-Buf-Type-Rec *(Data-Buffer-Type-Receive)*
21. Data-Buf-Type-Trans *(Data-Buffer-Type-Transmit)*
22. Data-Cylinders
23. Dedicated-Diagnostic-Areas
24. Disk-Recording-Density
25. Display-Protocols
26. DMA-Supported *(Direct-Memory-Access-Supported)*
27. Emulation-Capability
28. Encoding-Std *(Encoding-Standard)*
29. Error-Handling-Bits
30. External-Address-Width
31. External-Cntrl-Stat-Width *(External-Control-Status-Width)*
32. External-Data-Width
33. Formatted-Capacity
34. Graphics-Capability
35. Interleaving *(Interleaving-Capability)*
36. Internal-Address-Width
37. Internal-Cntrl-Stat-Width *(Internal-Control-Status-Width)*
38. Internal-Data-Width
39. Interrupt-Priority-Level
40. Map-Reg-Address-Width *(Map-Register-Address-Width)*
41. Max-Command-Buffer-Size *(Maximum-Command-Buffer-Size)*
42. Max-Devices-Per-Port *(Maximum-Devices-Per-Port)*
43. Max-Error-Correct *(Maximum-Error-Correction)*
44. Max-Error-Detect *(Maximum-Error-Detection)*
45. Max-Packet-Size *(Maximum-Packet-Size)*
46. Max-Array-Size *(Maximum-Array-Size)*
47. Mem-Addr-Space-Supported *(Memory-Address-Space-Supported)*
48. Memory-Capacity

49. Min-Packet-Size *(Minimum-Packet-Size)*
50. Mode-of-Transmission
51. Modem-Config-Supported *(Modem-Configuration-Supported)*
52. Net-Topology *(Network-Topology)*
53. Numb-of-Addr-Translat-Buf *(Number-of-Address-Translation-Buffers)*
54. Numb-of-Adrsbl-Registers *(Number-of-Addressable-Registers)*
55. Numb-of-Bidirect-Lines *(Number-of-Bidirectional-Lines)*
56. Numb-of-Map-Registers *(Number-of-Map-Registers)*
57. Numb-of-Priority-Levels *(Number-of-Priority-Levels)*
58. Numb-of-Unidirect-Lines *(Number-of-Unidirectional-Lines)*
59. Order-of-Bits
60. Overlapped-Arbitration
61. Port-Operating-Mode
62. Ports-Supported
63. Preamble-Generate-Cap *(Preamble-Generate-Capability)*
64. Preamble-Length-Max *(Preamble-Length-Maximum)*
65. Preamble-Length-Min *(Preamble-Length-Minimum)*
66. Printer-Port
67. RAM-or-CAM-or-SAM *(Random-Addressable-or-Content-Addressable-or-Serially-Addressable-Memory)*
68. ROM-or-RWM *(Read-Only-or-Read-Write-Memory)*
69. Serial-Cntrl-Stat-Bits *(Serial-Control-Status-Bits)*
70. Serial-Data-Bits
71. Split-Speed-Capability
72. Standard-Array-Size
73. Static-or-Dynamic
74. Streaming-Capability
75. Surface-Type
76. Tape-Recording-Density
77. Tracks-Per-Cylinder
78. Unformatted-Capacity
79. Volatile-or-Nonvolatile

5.2 BEHAVIORAL ATTRIBUTES

Behavioral attributes are system attributes related to the action, reaction, or function of the elements of a computer system. Behavioral attributes specify the time-related or sequence-related parameters of the element.

1. Arbitration-Timing
2. Avg-Data-Rate *(Average-Data-Rate)*
3. Broad-Rec-Freq *(Broadband-Receive-Frequency)*
4. Broad-Trans-Freq *(Broadband-Transmit-Frequency)*
5. Data-Buffer-Purge-Method
6. Error-Handling-Type
7. Ethernet-Trans-Tech *(Ethernet-Transmission-Technology)*
8. Flow-Control
9. Generate-Detect-CRC *(Generate-Detect-Cyclic-Redundancy-Check)*
10. Internal-Clock-Frequency
11. Interrupt-Arbitration-Typ *(Interrupt-Arbitration-Type)*
12. Max-Data-Rate *(Maximum-Data-Rate)*
13. Max-Read-Access-Cache *(Maximum-Read-Access-Cache)*
14. Max-Read-Access-Time *(Maximum-Read-Access-Time)*
15. Max-Request-Latency-Time *(Maximum-Request-Latency-Time)*
16. Max-Rotat-Latency-Time *(Maximum-Rotational-Latency-Time)*
17. Max-Seek-Time *(Maximum-Seek-Time)*
18. Max-Settle-Time *(Maximum-Settle-Time)*
19. Max-Throughput *(Maximum-Throughput)*
20. Min-Interframe-Gap *(Minimum-Interframe-Gap)*
21. Min-Memory-Cycle-Time *(Minimum-Memory-Cycle-Time)*
22. Min-Read-Access-Cache *(Minimum-Read-Access-Cache)*
23. Min-Read-Access-Time *(Minimum-Read-Access-Time)*
24. Min-Seek-Time *(Minimum-Seek-Time)*
25. Min-Settle-Time *(Minimum-Settle-Time)*
26. Numb-of-Retrys *(Number-of-Retrys)*
27. Port-Access-Timeout
28. Port-Clock-Frequency
29. Port-Operations-Supported
30. Ramp-Up-Time
31. Rewind-Speed

32. Rotational-Deviation
33. Rotational-Speed
34. Routing-Method
35. Slave-Response-Timeout
36. Split-Sp-Rec-Max-Data *(Split-Speed-Receive-Maximum-Data-Rate)*
37. Split-Sp-Trans-Max-Data *(Split-Speed-Transmit-Maximum-Data-Rate)*
38. Start-Time
39. Stop-Time
40. Tape-R/W-Speed-Start-Stop *(Tape-Read/Write-Speed-Start-Stop)*
41. Tape-R/W-Speed-Streaming *(Tape-Read/Write-Speed-Streaming)*
42. Type-Allocation-Rules

5.3 STRUCTURAL ATTRIBUTES THAT IMPLY BEHAVIOR

These are the Structural Attributes that may also affect Behavioral characteristics of a product; thus, they may need to be considered when determining the dynamic behavior of a system.

1. Address-Filtering
2. Arbitrator
3. Block-Mode-Transfers
4. Cache-Memory-Capability
5. Display-Protocols
6. DMA-Supported *(Direct-Memory-Access-Supported)*
7. Emulation-Capability
8. Graphics-Capability
9. Interleaving *(Interleaving-Capability)*
10. Max-Error-Correct *(Maximum-Error-Correction)*
11. Max-Error-Detect *(Maximum-Error-Detection)*
12. Modem-Config-Supported *(Modem-Configuration-Supported)*
13. Overlapped-Arbitration
14. Port-Operating-Mode
15. Preamble-Generate-Cap *(Preamble-Generate-Capability)*
16. Split-Speed-Capability
17. Streaming-Capability

5.4 BEHAVIORAL ATTRIBUTES THAT IMPLY STRUCTURE

These are the Behavioral Attributes that also dictate some of the Structural properties of a product and may need to be considered when evaluating static characteristics of a System configuration.

1. Data-Buffer-Purge-Method
2. Error-Handling-Type
3. Ethernet-Trans-Tech *(Ethernet-Transmission-Technology)*
4. Flow-Control
5. Interrupt-Arbitration-Typ *(Interrupt-Arbitration-Type)*
6. Routing-Method
7. Type-Allocation-Rules

CHAPTER 6

ATTRIBUTE THESAURUS

This chapter provides an attribute thesaurus in a tabular form. The left column in the following table gives the name of the system interaction attribute as used in SLDA; the right column lists various synonyms used for the same attribute in different Engineering specifications for products. Note that there may be other applicable terms not included in this table; efforts will be made to include all applicable terms in future revisions.

ATTRIBUTES	ALIASES (SYNONYMS)
AVG-DATA-RATE	TYPICAL-DATA-TRANSFER-RATE IO-DATA-RATE-PEAK AVG-TRANS-RATE-DRV-CNTLR AVE-TRANS-RATE-DEV-ADPTR AVE-TRANS-RATE-ADPTR-MEM
CHARACTER-SET-TYPE	CHARACTER-SET-N-TYPE
CONTROL-STORE-FIXED-SIZE	CONTROL-STORE-SIZE
CONTROL-STORE-WRTBL-SIZE	CONTROL-STORE-SIZE
DATA-BUFFER-PURGE-METHOD	DATA-BUFFER-PURGE-METHOD-TRANSMIT DATA-BUFFER-PURGE-METHOD-RECEIVE
DEDICATED-DIAGNOSTIC-AREAS	NUMBER-CYLINDER-DIAGNOSTICS CYLINDERS-DIAGNOSTIC
DISK-RECORDING-DENSITY	RECORDING-DENSITY
DISPLAY-PROTOCOLS	CHARACTER-SET-NAMES
EXTERNAL-ADDRESS-WIDTH	NUMBER-OF-ADDRESS-LINES ADDRESS-WORD-WIDTH
EXTERNAL-CNTRL-STAT-WIDTH	NO-CNTRL-LINES-TO-DEVICE CONTROL-WORD-WIDTH

ATTRIBUTES	ALIASES (SYNONYMS)
EXTERNAL-DATA-WIDTH	WORD-SIZE NUMBER-OF-OUTPUT-D-LINES NUMBER-OF-DATA-LINES NUMBER-OF-OUTPUT-DATA-LINES NO-OUTPUT-D-LINES-FRM-DEV MEMORY-DATA-BUS-WIDTH DATA-WRD-TO-SYST-BUS-WIDTH DATA-WORD-TO-SYSTEM-BUS-WIDTH DATA-WORD-WIDTH DATA-WORD-TO-DEVICE-WIDTH
FORMATTED-CAPACITY	MAX-CAPACITY-PER-REEL CAPACITY-PER-REEL
INTERNAL-ADDRESS-WIDTH	NUMBER-OF-ADDRESS-LINES ADDRESS-WORD-WIDTH
INTERNAL-CLOCK-FREQUENCY	CLOCK-FREQUENCY
INTERNAL-CNTRL-STAT-WIDTH	NO-CNTRL-LINES-TO-DEVICE CONTROL-WORD-WIDTH
INTERNAL-DATA-WIDTH	WORD-SIZE NUMBER-OF-OUTPUT-D-LINES NUMBER-OF-INPUT-DATA-LINES NUMBER-OF-DATA-LINES NUMB-OF-INPUT-DATA-LINES NO-OUTPUT-D-LINES-FRM-DEV MEMORY-DATA-BUS-WIDTH INTERNAL-DATA-BUS-WIDTH DATA-WRD-TO-SYST-BUS-WIDTH DATA-WORD-TO-SYSTEM-BUS-WIDTH DATA-WORD-WIDTH DATA-WORD-TO-DEVICE-WIDTH
MAX-DATA-RATE	PK-TRANS-RATE-DRIVE-CNTLR PK-TRANS-RATE-DEV-ADPTR PK-TRANS-RATE-CONTROLLER-BUS PK-TRANS-RATE-CNTLR-MEM PK-TRANS-RATE-CNT-BUS-ADP PK-TRANS-RATE-ADAPTER-MEMORY PEAK-TRANS-RATE-ADAPT-MEM

ATTRIBUTES	ALIASES (SYNONYMS)
MAX-DATA-RATE (continued)	PEAK-I/O-DATA-RATE MAX-DATA-TRANSFER-RATE MAX-DATA-RATE-INTERF-BUS IO-DATA-RATE-PEAK-AVG
MAX-READ-ACCESS-CACHE	INSTRUCTION-EXEC-RATE-FROM-CACHE CACHE-CYCLE-TIME
MAX-READ-ACCESS-TIME	MAX-ACCESS-TIME ACCESS-TIME
MAX-REQUEST-LATENCY-TIME	MAXIMUM-LATENCY-TIME
MAX-ROTAT-LATENCY-TIME	MAXIMUM-LATENCY-TIME
MEM-ADDR-SPACE-SUPPORTED	ADDRESS-SPACE-SIZE
MIN-INTERFRAME-GAP	INTERFRAME-GAP
MIN-MEMORY-CYCLE-TIME	MEMORY-CYCLE-TIME
MIN-READ-ACCESS-CACHE	INSTRUCTION-EXEC-RATE-FROM-CACHE CACHE-CYCLE-TIME
MIN-READ-ACCESS-TIME	MIN-ACCESS-TIME ACCESS-TIME
MIN-SEEK-TIME	TRACK-TO-TRACK-SEEK-TIME
MODEM-CONFIG-SUPPORTED	MODEM-SUPPORT
NUMB-OF-ADRSBL-REGISTERS	NUMBER-OF-REGISTERS
NUMB-OF-BIDIRECT-LINES	NO-BIDIRECT-LINES-TO-DEV
NUMB-OF-UNIDIRECT-LINES	NO-UNIDIRECT-LINES-TO-DEV
PORT-ACCESS-TIMEOUT	TIME-OUT-PERIOD
PORT-CLOCK-FREQUENCY	CLOCK-FREQUENCY

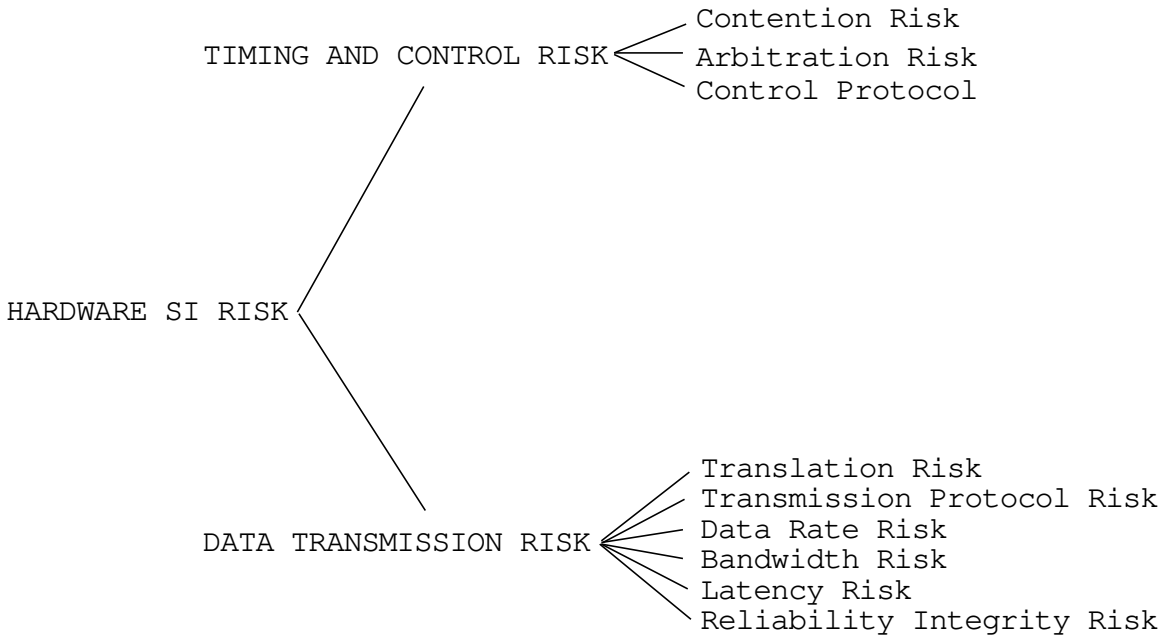
ATTRIBUTES	ALIASES (SYNONYMS)
PORT-OPERATIONS-SUPPORTED	TYPE-OF-OPERATION DATA-TRANSFER-MODE BUS-TRANSFERS-SUPPORTED
PORTS-SUPPORTED	DRIVES-CONTROLLED
SERIAL-CNTRL-STAT-BITS	NUMBER-OF-STOP-BITS
SLAVE-RESPONSE-TIMEOUT	TIME-OUT-PERIOD NON-EXISTENT-MEMORY-TIMEOUT
STATIC-OR-DYNAMIC	STATIC/DYNAMIC STATIC-DYNAMIC REFRESH
STREAMING-CAPABILITY	STREAMING-VS.-START/STOP
TAPE-R/W-SPEED-START-STOP	TAPE-READ-WRITE-SPEED
TAPE-R/W-SPEED-STREAMING	TAPE-READ-WRITE-SPEED
TAPE-RECORDING-DENSITY	RECORDING-DENSITY

CHAPTER 7

SYSTEM INTERACTION RISK CLASSIFICATIONS

This chapter describes the System Interaction Risks (refer to Figure 2) associated with the hardware failures of systems. These failures are the result of the unexpected behavior of hardware that occurs when a system, cluster, or network is operated as a unit; these failures do not occur when the components are operated individually.

Figure 2: Hardware System Interaction (SI) Risks



ARBITRATION-RISK
A risk that occurs when the arbitration method of a system does not properly allocate common resources under certain conditions.

BANDWIDTH-RISK
Any risk due to the operation of multiple devices on a common medium where the sum of all device data rates exceeds the capacity of the transmission medium.

CONTENTION-RISK
Any risk due to two or more devices simultaneously attempting access of a common resource.

CONTROL-PROTOCOL-RISK
Any risk due to the violation of timing and control rules between two devices.

DATA-RATE-RISK
Any risk due to the mismatch of data rates between devices (that is, it is connection dependent).

DATA-TRANSMISSION-RISK
Any risk due to the inability to transfer information from one device to another through a common transmission medium.

HARDWARE-SI-RISK
All risks that are only found in combination with other system modules; these risks do not occur when the hardware (or component) is tested separately.

LATENCY-RISK
Any risk due to the excessive delay of a response.

RELIABILITY-INTEGRITY-RISK
Any risk of unacceptable loss or corruption of data due to unexpected environmental conditions (note: component failure is not a system-level risk).

TIMING-AND-CONTROL-RISK
Any risk associated with the access of a common resource for control transfer.

TRANSLATION-RISK
Any risk due to unsupported transactions or unsupported data sizes.

TRANSMISSION-PROTOCOL-RISK
Any risk due to the violation of data transmission rules between two devices (data defined here as an address, command, or data information).

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TAY2-2/F2.

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